WHAT IS CLAIMED IS:

1. An isolated nucleic acid comprising a polynucleotide sequence encoding a vanadium bromoperoxidase polypeptide comprising an amino acid sequence having at least 90% amino acid sequence identity to an amino acid sequence from residue 441 to residue 676 as set forth in SEQ ID NO:2, wherein the polypeptide catalyzes the oxidation of o-dianisidine (ODA) when complexed with a vanadium ion.

2. The isolated nucleic acid of claim 1, wherein the polynucleotide sequence has at least 60% sequence identity to a sequence as set forth in SEQ ID NO:1.

3. The isolated nucleic acid of claim 1, wherein the polynucleotide sequence is as set forth in SEQ ID NO:1.

4. The isolated nucleic acid of claim 1, wherein the polypeptide has at least 80% identity to a sequence as set forth in SEQ ID NO:2.

5. The isolated nucleic acid of claim 1, wherein the polypeptide has an amino acid sequence as set forth in SEQ ID NO:2.

6. The isolated nucleic acid of claim 1, wherein the polypeptide has a molecular weight of about 73.4 kD.

7. The isolated nucleic acid of claim 1, wherein the polypeptide has a molecular weight of about 58 kD.

8. The isolated nucleic acid of claim 1, wherein the polypeptide has a molecular weight of about 40 kD.

9. The isolated nucleic acid of claim 1, wherein the polynucleotide sequence is operably linked to a promoter sequence.

10. An expression cassette comprising a heterologous promoter operably linked to a nucleic acid encoding a polypeptide comprising an amino acid sequence having at least 90% amino acid sequence identity to an amino acid sequence from residue 441 to residue 676 of SEQ ID NO:2, wherein the polypeptide catalyzes oxidation of o-dianisidine (ODA) when complexed with a vanadium ion.

11. The expression cassette of claim 10, wherein the nucleic acid has at least 95% sequence identity to a nucleic acid sequence as set forth in SEQ ID NO:1.

12. The expression cassette of claim 10, wherein the nucleic acid has a nucleic acid sequence as set forth in SEQ ID NO:1.

13. The expression cassette of claim 10, wherein the polypeptide has at least 80% identity to a polypeptide as set forth in SEQ ID NO:2.

14. The expression cassette of claim 10, wherein the polypeptide has a sequence as set forth in SEQ ID NO:2.

15. A cell comprising the expression cassette of claim 10.

16. An isolated polypeptide comprising an amino acid sequence having at least 90% amino acid sequence identity to a sequence from residue 441 to residue 676 as set forth in SEQ ID NO:2, wherein the polypeptide catalyzes oxidation of o-dianisidine (ODA) when complexed with a vanadium ion.

17. The isolated polypeptide of claim 16, wherein the polypeptide has at least 80% identity to a polypeptide as set forth in SEQ ID NO:2.

18. The isolated polypeptide of claim 16, wherein the polypeptide has a sequence as set forth in SEQ ID NO:2.

19. The isolated polypeptide of claim 16, wherein the polypeptide has a molecular weight of about 73.4 kD.

20. The isolated polypeptide of claim 16, wherein the polypeptide has a molecular weight of about 58 kD.

21. The isolated polypeptide of claim 16, wherein the polypeptide has a molecular weight of about 40 kD.

22. The isolated polypeptide of claim 16, wherein the polypeptide is immobilized on a solid surface.

23. The isolated polypeptide of claim 16, wherein the polypeptide further comprises a cleavable linker sequence.

24. The isolated polypeptide of claim 23, wherein the cleavable linker sequence is an enterokinase cleavable linker sequence.

25. The isolated polypeptide of claim 16, wherein the polypeptide further comprises an epitope tag.

26. The isolated polypeptide of claim 25, wherein the epitope tag comprises a plurality of histidine residues.

27. The isolated polypeptide of claim 16, wherein the polypeptide further comprises a thioredoxin sequence.

28. A method for enzymatically halogenating a compound, the method comprising contacting the compound with an isolated polypeptide of claim 16.

29. The method of claim 28, wherein the compound is a protein.

30. A method for enzymatically oxidizing a compound, the method comprising contacting the compound with an isolated polypeptide of claim 16.